UDC 004.415.2.043+004.422.635.5+378.147.88

DATA STRUCTURE DESIGNING OF THE INTERNAL COMPONENT LIBRARIES FOR LEARNING EXPERIMENT ENVIRONMENT

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It has been substantiated that the layout of the scheme of the educational experiment and further research of the subject area by the authorized user of educational space is hindered by the lack of common tools and standards for maintaining a sufficient and relevant nomenclature of components. It is shown that the available solutions do not fully provide a hierarchical ordering of component attributes in the data structure of the internal library.

A unified specification of the packed file format of the internal library for different types of components has been designed to provide data flow support for software developed within the virtual platform of learning research. The hierarchical format is based on the ANSI-description of the subject area components and is suitable for constructing a ramified contour of experimental scheme and further transitional processes studying.

Keywords: *learning experiment environment, data structure, subject area, internal component library.*

Formulation of the problem. Computerized environments of design works and of subject area modeling use flexible file formats for interaction and data exchange. The need for adequate data structures for specific subject areas is common in many scientific branches. Most representatives of technically oriented community operate with standardized file formats from LabVIEW, Micro-Cap, MATLAB, etc.

If these or other common specifications are used in original experimental research environments, it may take a long time to process all the available tags. Taking into account the multidisciplinary character of such educational environments, the scheme of a particular experiment uses only a small part of the specification, depending on the subject area. Also, these formats are protected by patent law with trade secrets elements and their data structures do not take into account a number of research nuances in qualified professionals training within the industry educational institution. Therefore, the analysis of file specifications in order to find adequate for components attributes preserve of subject area is necessary for effective deployment of virtual platform environment of learning experiment, which is organically integrated into academic information space.

Analysis of recent research and publications. Scientists from world educational institutions pay attention to the problems of data selection and formatting in context

of the gathered subject area. So, the specification of the data structure for the "NANOQUANTA" network, which is covered in one of the projects of European researchers [1], based on the binary I / O library NetCDF, provides access to data using keywords, is mostly focusing on highly specialized protocols for automatic calculation of properties with different levels of approximation. Another project, presenting the original coding system of structure of latticed and supporting constructions [2], varying the repetition of similar fragments of geometry, reduces the resulting file size in solving the problem of weighted optimizing the exact coverage: presented narrowly specialized specification is implemented in customizable framework form with allowable data loss. The following published results on the implementation of the binary format of serialization from the family of standards EXPRESS demonstrate random access to specific components and, consequently, the effective search for appropriate subsets in specification [3], but requiring the semantic formalization of trivial tasks. Another solution, which is to constantly add to basic specification the necessary information of subject area in specialized metadata form, was proposed in [4], which in an interdisciplinary platform will generally lead to a sharp redundancy of data flow.

The open data format HDF5, specialized by researchers at the University of California, stores data on subject area components from any supervisory equipment [5], as well as settings and description of components; here the possibility of including information on the his origin, authorship and other, through own, metadata attracts attention. Developed at the Notre Dame University, the Umbrella based specification framework for processing nodes of scientific workflows allows to save the dependencies of each node (component) linked to its image [6], while losing the sequence of components. The SPD format proposed by Australian researchers [7] supports two-dimensional spatial indexing of components with reference using Cartesian, spherical, polar or scanning coordinate and projection systems: these indexes are later used for accelerated access to visual instances of the subject area, however, without the ability to saving their attributes.

In general, the ordering of data in considered specifications structures, mainly binary format, leads to the formation of long and complex scenarios with low-level operations performancing, the processing of which takes a extended time with ambiguous interpretation of result. The lack of a multidisciplinary hierarchy of component attributes and a miss of support of a ramify contour of the experimental scheme and nothing of further educational-oriented study of transients with control of competencies and accumulation of typical errors does not contribute to the application of published solutions for subject area composing in environment of designed virtual platform of the learning experiment.

The purpose of the article — the data structure designing of internal component libraries for cross-academic virtual platform of experimental research at implementation of the cognitive factor of educational process in qualified specialists training. Unlike methods based on complex scenarios, where most developers provide data storage in their own formats, which are created to order with binding to the specific subject area and which are difficult to provide for post-processing [1-

7], proposed expansion of internal libraries by adding original components directly by means of toolkit the designed multidisciplinary environment of educational experiment or from external libraries with the subsequent adaptation and converting, will provide permanent updating of educational content and will directly provide learning means, including targeted methodological support in accordance with the standards and requirements of the relevant industry.

Presentation of the main research material. One of important tasks solved when designing the unified data structure of internal componentic libraries is to content tags determine (Fig. 1) for components of researching subject area [8], with initialization of which in end-terminal builds a scheme of educational experiment. Such libraries are loaded from individual pre-prepared packed files at the request of procedural module into a memory segment, which is allocated for deployment of software suite of computerized environment for laboratory stand simulation. The internal libraries files of media platform of experimental research are identified in system register [9] by the original extension *.CXO and constitute the toolkit for working field of application window [10]. Exactly this separate defined toolbar button that provides access to corresponding component from current library.

The initial title head # informs the analytical apparatus of virtual laboratory directly about the beginning of data flow of the initiated component # among other structures of packaged file of the internal library. The general description tag contains the type identifier of current component, the displacement signature of component section in packaged file and its control checksum in the form of cyclic redundancy hash, CRC. This presented data structure serves to enable the reading unit to analyze the process correctness and identify a damaged or invalid library. Such information must be unambiguously processed by the analytical apparatus of the virtual laboratory before other content tags of format notation for initiated component of current internal library are processed.

The information block of specification contains the component instance class identifier IdClass, which is necessary for further processing in object-oriented environment of infocommunication platform in experimental scheme circuit. Also, this tag contains ANSI records with component name Name_C, its conventional sign Cond_M and measurements unit Units, which are custom displayed later in graphic image of subject area. Last tag entry may store optional information about a formalized mathematical model that describes the component functioning and will be needed for further study of transients in constructed experiment scheme.

Theoretical information for methodical support of laboratory workshops is covered by the accompanying block. Here's indicated is the context fill to Hint drop-down suggestion for component initiation button on the toolbar of the appropriate library and the help section descriptor for an extended explanation of the subject area of the learning experiment. For further methodological support of design works, the Task tag contains a list of descriptors for access to sections of electronic tutorials with the sequence of the exercise and a description of the subject area with a total volume of up to 255 bytes.

H E A D of Pack	
CAT	**class allocation table**
IdLib	**library identifier**

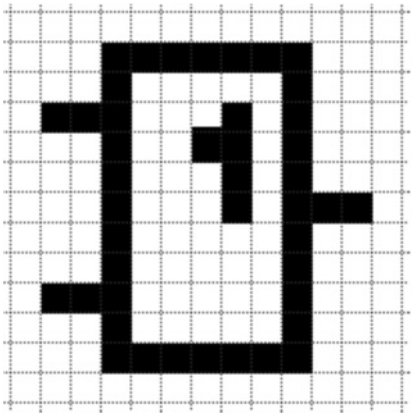
H E A D #i	
GENERAL DESCRIPTION	
IDType	type identifier
Shift	displacement signature
CRC	checksum
INFORMATION BLOCK	
IdClass	class identifier
Name_C	component name
Cond_M	conventional sign
Units	measurements unit
Model	mathematical model
ACCOMPANYING BLOCK	
Hint	drop-down suggestion
Help	help section descriptor
Task	tutorial descriptor section
GRAPHICAL BLOCK	
BitMap	raster array
Width	canvas width
Height	canvas height
PointCon	gateways array
Icon	miniature
COLOR BLOCK	
BorderPalette	borders color scheme
BackPalette	background color scheme
ColorDepth	color depth
PARAMETER BLOCK	
Nom	nominal value
Max	maximum value
Min	minimum value
E O F #i	

Fig. 1. Specification structure of container the internal library

Appearance of current component is stored in records of graphic block tag. Raster array of selected prototype instance (Fig. 2, a) in bitmap form (Fig. 2, b) will be located in fragment of screen canvas within Width and Height and will connect with other components of the subject area through the corresponding of PointCon gateways array. The Icon miniature is displayed on initiation butto n of desired component from toolbar of library in use. Display features of graphic block hypertag components are directly related to system settings of end-terminal, stored in records of next hypertag from structure of format specification the internal library.

Thus, in the case of traditional monochrome reproduction of the learning experiment scheme, the color block tag is left blank, but when creating

a multicolor component, it is possible to specify the color scheme of the BorderPalette component and its BackPalette background with the available ColorDepth, which provide hardware attributes for reproducing component colors on the monitor screen.



a

0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	1	1	1	1	1	1	0	0	0
0	0	0	1	0	0	0	0	0	1	0	0	0
0	1	1	1	0	0	0	1	0	1	0	0	0
0	0	0	1	0	0	1	1	0	1	0	0	0
0	0	0	1	0	0	0	1	0	1	0	0	0
0	0	0	1	0	0	0	1	0	1	1	1	0
0	0	0	1	0	0	0	0	0	1	0	0	0
0	0	0	1	0	0	0	0	0	1	0	0	0
0	1	1	1	0	0	0	0	0	1	0	0	0
0	0	0	1	0	0	0	0	0	1	0	0	0
0	0	0	1	1	1	1	1	1	1	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0

b

Fig. 2. Component visualization example of class OR from library PTCA.CXO

The last content tag parameter block contains records with a list of possible minimum Min, nominal Nom and maximum Max value of the current component, the measurements units of which are stored in the Units record of the previously described tag information block. In general, the contents of the paragraph block hypertag entries are also optional. Together with the descriptors of supporting block and Model record of information block, the main mechanisms of integration of media platform of the virtual laboratory into the information space of the academic educational environment are concentrated here. The EOF # tag indicates the completion of the data flow describing the attributes of the current component # in the structure of packaged library file.

Conclusions. Thus, in the presented data structure of the package specification file of the internal component library of the learning experiment environment, the current instance of the subject area object is determined by a two-element tuple {IdLib, IdClass}. Common header tag of container contains the IdLib library identifier and allocation table CAT of prototypes components for their prompt identification. This structure is also the basis of algorithm for converting external libraries to standardize the data flows of the virtual laboratory.

To ulterior expand the project of infocommunicative platform of experimental research, it is planned to formalize mathematical models of common components of subject area of disciplines of basic, professional and practical training in study future professionals according to relevant higher education standard.

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DOI 10.32403/2411-9210-2021-2-46-73-80

ПРОЕКТУВАННЯ СТРУКТУРИ ДАНИХ ВНУТРІШНІХ КОМПОНЕНТНИХ БІБЛІОТЕК СЕРЕДОВИЩА НАВЧАЛЬНОГО ЕКСПЕРИМЕНТУ

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Обґрунтовано, що компонуванню схеми навчального експерименту та подальшому дослідженню предметної області авторизованим користувачем освітнього простору перешкоджає відсутність загальних інструментів та стандартів збереження достатньої й актуальної номенклатури компонентів. Показано, що наявні рішення не повною мірою забезпечують ієрархічне впорядкування атрибутів компонентів у структурі даних внутрішньої бібліотеки.

Виконано проектування уніфікованої специфікації формату упакованого файлу внутрішньої бібліотеки для різних типів компонентів, щоб забезпечити супровід потоків даних для програмного забезпечення, розробленого в межах віртуальної платформи навчальних досліджень. Ієрархічний формат базується на ANSI-описі компонентів предметної області, та придатний для

використання у компонуванні розгалуженого контуру схеми експерименту і подальшого дослідження перехідних процесів.

Ключові слова: *середовище навчального експерименту, структура даних, предметна область, внутрішня компонентна бібліотека.*

Стаття надійшла до редакції 25.05.2021
Received 25.05.2021